



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>6</sup> : H04Q 7/38	A1	(11) International Publication Number: WO 99/33300
		(43) International Publication Date: 1 July 1999 (01.07.99)

(21) International Application Number: PCT/FI98/01010

(22) International Filing Date: 21 December 1998 (21.12.98)

(30) Priority Data:  
974590 22 December 1997 (22.12.97) FI(71) Applicant (for all designated States except US): SONERA OY  
[FI/FI]; Teollisuuskatu 15, FIN-00510 Helsinki (FI).

(72) Inventors; and

(75) Inventors/Applicants (for US only): GRÖHN, Tuomo [FI/FI];  
Hämeentie 70 D 66, FIN-00550 Helsinki (FI). PERÄ,  
Olli [FI/FI]; Candelintie 4 B 4, FIN-90570 Oulu (FI).  
ALA-LUUKKO, Sami [FI/FI]; Paraistentie 18 A 2,  
FIN-00280 Helsinki (FI). SARKKI, Mika [FI/FI]; Norotie  
6 D 41, FIN-01600 Vantaa (FI).(74) Agent: PAPULA REIN LAHTELA OY; Fredrikinkatu 61 A,  
P.O. Box 981, FIN-00101 Helsinki (FI).(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR,  
BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD,  
GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP,  
KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK,  
MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG,  
SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU,  
ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG,  
ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ,  
TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI,  
FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent  
(BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE,  
SN, TD, TG).

## Published

With international search report.

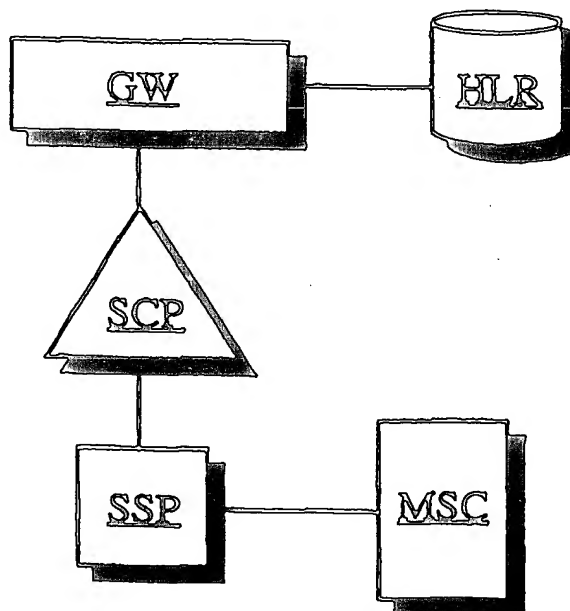
Before the expiration of the time limit for amending the  
claims and to be republished in the event of the receipt of  
amendments.

In English translation (filed in Finnish).

(54) Title: PROCEDURE AND SYSTEM FOR THE TRANSMISSION OF INFORMATION AND SETTING UP OF A TELECOMMUNICATION CONNECTION

## (57) Abstract

Procedure and system for optimisation of the route of a telecommunication connection to be set up in a telecommunication system comprising a mobile switching centre (MSC), a service switching point (SSP), a service control point (SCP), a gateway (GW) and a subscriber register (HLR). In the procedure, the service switching point (SSP) is connected to the service control point (SCP) and the gateway (GW) is connected to the service control point (SCP) and to the subscriber register (HLR). The telecommunication connection to be set up is directed via the service switching point (SSP) to the service control point (SCP). A database query is sent from the service control point (SCP) via the gateway (GW) to the subscriber register (HLR). The subscriber register provides routing information, on the basis of which an optimal route to the mobile switching centre under which the B-subscriber is located is determined.



**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

PROCEDURE AND SYSTEM FOR THE TRANSMISSION OF  
INFORMATION AND SETTING UP OF A TELECOMMUNICATION  
CONNECTION

5 SCOPE OF THE INVENTION

The invention relates to telecommunication technology. In particular, the invention is utilised in the optimisation of the route of a telecommunica-  
10 tion connection set up in a mobile communication network.

BACKGROUND OF THE INVENTION

15 For a teleoperator, it is important that telecommunication connections be set up in an optimal manner. Optimisation may be based e.g. on the length of the route of the connection or on the network load resulting from the telecommunication connection. The  
20 traffic in mobile communication networks is continuously increasing. Therefore, it is particularly important that the load in the mobile communication network should remain as low as possible. One approach to reducing the load in a mobile communication network is  
25 to set up the connection to the called subscriber's mobile switching centre via a route as short as possible.

PRIOR ART

30 An intelligent network consists of switching, controlling and functional components and a signalling network. A service switching point (SSP) is a modified telephone exchange which analyses the traffic passing  
35 through it. When it detects a certain number that meets a triggering criterion, the service switching

point SSP sends a service request to a service control point (SCP). The information required for service control is stored in a service data point (SDP), where the service control point can obtain the information it needs.

Service switching points are connected via signalling channels to service control points, which implement intelligent network services by utilising a service database. A service control point may perform e.g. a number conversion from B-number to C-number by getting the C-number corresponding to a B-number from the service database.

The communication protocols used in an intelligent network are rules by which the components of the intelligent network talk to each other. The protocol defines the interfaces between components as well as the structure of the messages exchanged between them. Intelligent network components communicate with each other using common channel signalling (CCS). As an ITU-T definition, common channel signalling is known as CCSS No7. For communication between components, an intelligent network uses the services of the INAP (Intelligent Network Application Part) defined by ITU-T. The INAP application part is an intelligent network application protocol used e.g. for communication between a service control point and a service switching point. On the other hand, the MAP application part is a part of the signalling system of a mobile communication network and is used for signalling between the switching centres and registers of the mobile communication network.

In the GSM (Global System for Mobile communications) system, a call to be set up is routed as follows. A call setup request is sent from the calling subscriber's (A-subscriber's) terminal equipment to a gateway mobile switching centre (GMSC), which sends a

query to the called subscriber's (B-subscriber's) home location register (HLR) to determine the mobile switching centre (MSC) under which the B-subscriber's terminal device is currently located. The home location register is a database which contains information including subscriber data, subscriber location data, call control data, short-message services and billing data.

Next, the home location register requests the visitor location register (VLR) for a roaming number (MSRN, Mobile Subscriber Roaming Number) and returns the roaming number to the GMSC. The visitor location register is a database in a mobile communication network which contains the information required for the transmission of calls about each mobile subscriber currently located in the area of the network. The roaming number is a temporary identification number which is allocated to a mobile station recorded in the visitor location register and which is used by the mobile communication system for the routing of calls addressed to the subscriber.

After this, based on the roaming number, the GMSC routes the call originated by the A-subscriber to the mobile switching centre in whose location area (LA) the B-subscriber is located. The B-subscriber's mobile switching centre in turn sets up a connection with the B-subscriber's terminal device.

In the routing procedure described above, the problem is that calls addressed to mobile stations are not automatically routed via the shortest route to the right mobile switching centre but may instead be routed via several switching centres. A solution applied to eliminate this problem is to provide some service nodes (SN) and service control points with a MAP interface, which makes it possible to implement a functionality and service similar to the present in-

vention. Such solutions involve the problem that they bind the service to a certain base and assume that the service control point or service node is provided with a MAP interface.

5           In the procedure of the invention, the routing of calls addressed to a terminal device is optimised by using an intelligent network service and a special gateway. By means of the gateway, a query is sent from the intelligent network system to a subscriber regis-  
10       ter to obtain B-subscriber data and, using said data, the call to be set up is routed directly to the mobile switching centre in whose area the B-subscriber's terminal device is located. This also makes it possible to utilise other GSM network services as well.

15           The object of the present invention is to eliminate the drawbacks described above or at least to reduce them significantly.

          A specific object of the present invention is to disclose a new type of procedure and system for  
20       routing a call directly to the mobile switching centre under which the B-subscriber is located.

          As for the features characteristic of the invention, reference is made to the claims.

## 25   BRIEF SUMMARY OF THE INVENTION

          The procedure of the invention is used for the optimisation of the route of a telecommunication connection to be set up.

30           The telecommunication system of the invention comprises a mobile switching centre, a service switching point, a service control point, a gateway and a subscriber register. The service switching point is connected to the service control point. The subscriber  
35       register and the service control point are connected to the gateway. The gateway further comprises means

for handling a database query, a signalling query, a response to a database query and a response to a signalling query.

In the method of the invention, a telecommunication connection to be set up is directed via the service switching point to the service control point. From the service control point, a database query is performed, which is directed to the gateway. In the gateway, the database query is converted into a signalling query, which is sent to the subscriber register. Based on the data in the subscriber register, a response to the signalling query is defined and sent to the gateway. In the gateway, the response to the signalling query is converted into a response to the database query, on the basis of which the service control point determines an optimal route to the mobile switching centre.

In a preferred embodiment of the invention, the response to the signalling query contains routing information, which is used to optimise the route of the telecommunication connection to the mobile switching centre. After this, a connection to the mobile switching centre and further e.g. to the B-subscriber's terminal device is set up. The routing information is e.g. a roaming number, preferably the MSRN (Mobile Subscriber Roaming Number).

In a preferred embodiment of the invention, the gateway is a MAP-INAP gateway, which comprises means for controlling the interface between the service control point and the database as well as means for controlling the interface between the gateway mobile services switching centre and the subscriber register. The signalling query is preferably an MAP (Mobile Application Part) query and the database query is an SDP (Service Data Point) query. The service control

point of the intelligent network is thus enabled to use the subscriber data of the GSM network.

In a preferred embodiment of the invention, the subscriber register is the home location register  
5 of the GSM system.

The invention allows optimal routing to the mobile switching centre under which the B-subscriber is located. If, according to the data in the visitor location register, the subscriber cannot be reached,  
10 corresponding information is obtained. If the subscriber has transferred his/her calls to another number using the CFU (Call Forwarding Unconditional) supplementary service, this will also be known and the call can be routed to the forward number.

The solution of the invention does not require any changes in the elements of the mobile communication network or in the intelligent network because the invention implements the service by using a separate  
15 MAP-INAP base.

20

#### LIST OF ILLUSTRATIONS

In the following, the invention will be described in detail by the aid of an embodiment example,  
25 wherein

Fig. 1 presents a system according to the invention,

Fig. 2 presents an example of signalling in a preferred embodiment of the procedure of the invention,  
30 tion,

Fig. 3 presents an example of signalling in a preferred embodiment of the procedure of the invention, and

Fig. 4 presents an example of signalling in a preferred embodiment of the procedure of the invention  
35 in an error situation.

The system illustrated by Fig. 1 comprises a mobile switching centre (MSC), a service switching point (SSP), which is connected to a service control point (SCP). Further, the service control point (SCP) is connected to a gateway (GW), to which is also connected a subscriber register (HLR).

The signalling diagram presented in Fig. 2 comprises a service control point (SCP), an MAP-INAP gateway (GW), a home location register (HLR) and a visitor location register (VLR).

The signalling diagram in Fig. 3 comprises a service control point (SCP), an MAP-INAP gateway (GW) and a home location register (HLR).

The signalling diagram in Fig. 4 comprises a service control point (SCP), an MAP-INAP gateway (GW) and a home location register (HLR).

#### DETAILED DESCRIPTION OF THE INVENTION

In an embodiment as illustrated by Fig. 1, a call setup request is sent from the A-subscriber's terminal device to the gateway mobile services switching centre. The gate MSC detects the incoming call and directs it further to the service switching point. From the service switching point, the call is directed to the service control point, which performs a database query to obtain routing information. In the procedure of the invention, instead of directing the database query to the service data point, the query is directed to a MAP-INAP gateway, where a conversion from database query into signalling query is performed. The MAP-INAP gateway can be easily implemented e.g. by using a separate service node provided with the required applications for the implementation of the interfaces or by installing the application in an

existing intelligent network component, e.g. the service control point.

Next, the routing query is sent from the gateway to the B-subscriber's home location register, where a response to the signalling query is defined on the basis of the data in the home location register. The signalling query response consists of routing information, preferably a roaming number. The home location register returns the routing information to the gateway, which performs a conversion from signalling query response into database query response. Thus, the routing information is converted into a form understood by the service control point. After this, based on the database query response received, the service control point causes the service switching point to route the call directly to the mobile switching centre under which the B-subscriber's terminal device is located.

Fig. 2 presents an example of signalling in the procedure of the invention in a situation where the home location register provides a roaming number as a response to a database query. The service control point (SCP) sends a database query (DB-query) to obtain routing information (MSRN). The database query is directed to a MAP-INAP gateway (GW), where a conversion from database query into signalling query is performed. Next, the signalling query (Send.Routing.Inf) is sent from the gateway to the B-subscriber's home location register (HLR), where a response to the signalling query is defined on the basis of the data in the home location register. In currently used techniques, the subscriber location data is not always automatically updated from the visitor location register to the home location register. In this case, the home location register (HLR) must first get routing information (Provide.MSRN) from the visitor location

register (VLR). The home location register returns the response to the signalling query (HLR-response) to the gateway, which performs a conversion from signalling query response (HLR-response) to database query response (DB-response). The signalling query response (HLR-response) consists of routing information, preferably a roaming number.

Fig. 3 presents an example of signalling in a procedure according to the invention in a situation where the B-subscriber has forwarded his/her calls to a C-number. From the service control point (SCP), a database query (DB-query) is sent to obtain routing information (MSRN). The database query is directed to the MAP-INAP gateway (GW), where a conversion from database query into signalling query (Send.Routing.Inf) is performed. Next, the signalling query is sent from the gateway to the B-subscriber's home location register (HLR), where, based on the data in the home location register, a response to the signalling query is defined. The home location register HLR returns the response to the signalling query (Fwd.To.Number) to the gateway, which performs a conversion from signalling query response to database query response (DB-response). In the case of the present example, the response (Fwd.To.Number) to the signalling query is a C-number.

Fig. 4 presents an example of signalling in the procedure of the invention in a situation where the B-subscriber can not be reached or there is a malfunction in the telecommunication system. A database query (DB-query) is sent from the service control point (SCP) to obtain routing information. The database query is directed to the MAP-INAP gateway (GW), where a conversion from database query into signalling query is performed. Next, the signalling query (Send.Routing.Inf) is sent from the gateway to the B-

subscriber's home location register (HLR). Based on the information in the home location register, a response (Routing.Inf.Error) to the signalling query is defined. If the subscriber terminal has been shut off  
5 or the subscriber is outside the receiving area, then the response (Routing.Inf.Error) to the signalling query contains data indicating that the subscriber can not be reached. If there is a malfunction in the system, corresponding information can also be given to  
10 the service control point in the response (Routing.Inf.Error) to the signalling query. The home location register returns the signalling query response to the gateway, which performs a conversion from signalling query response to database query response (DB-error).  
15

The present application is based on the earlier Finnish application FI 982168 "Procedure and system for the transmission of information and setting up of a telecommunication connection", which has been  
20 filed by the same applicant as the present application and is included here by this reference.

The invention is not restricted to the examples of its embodiments described above, but many variations are possible within the scope of the inventive idea defined by the claims.  
25

## CLAIMS

1. Procedure for optimisation of the route of  
a telecommunication connection to be set up in a tele-  
communication system comprising a mobile switching  
5 centre (MSC), a service switching point (SSP), a serv-  
ice control point (SCP), a gateway (GW) and a sub-  
scriber register (HLR), in which procedure the service  
switching point (SSP) is connected to the service con-  
10 trol point (SCP) and the gateway (GW) is connected to  
the service control point (SCP) and to the subscriber  
register (HLR), and in which procedure the telecommu-  
nication connection to be set up is directed via the  
service switching point (SSP) to the service control  
15 point (SCP) and a database query is performed from the  
service control point (SCP), characterised  
in that the database query is addressed to the sub-  
scriber register (HLR) and, based on the response to  
the database query, an optimal route to the mobile  
20 switching centre is determined.

2. Procedure as defined in claim 1, characterised in that  
the database query is converted in the gateway  
(GW) into a signalling query;  
25 the signalling query is sent to the subscriber  
register (HLR);  
based on the data in the subscriber register  
(HLR), a response to the signalling query is defined;  
the response to the signalling query is sent to  
30 the gateway (GW);  
the response to the signalling query is converted  
into a response to the database query;  
the response to the database query is returned to  
the service control point (SCP);

routing information corresponding to the optimal telecommunication connection is generated on the basis of the response to the database query; and

based on the routing information, a telecommunication connection to the mobile switching centre is set up.

3. Procedure as defined in claim 1 or 2, characterised in that the response to the signalling query contains routing information.

10 4. Procedure as defined in claims 1 - 3, characterised in that the routing information consists of a roaming number, preferably the MSRN number (MSRN, Mobile Subscriber Roaming Number).

15 5. Procedure as defined in any one of claims 1 - 4, characterised in that the gateway is an MAP-INAP gateway comprising a database interface and a subscriber register interface.

20 6. Procedure as defined in any one of claims 1 - 5, characterised in that the signalling query is an MAP query (MAP, Mobile Application Part).

7. Procedure as defined in any one of claims 1 - 6, characterised in that the database query is an SDP query (SDP, Service Data Point).

25 8. Procedure as defined in any one of claims 1 - 7, characterised in that the subscriber register (HLR) is the home location register.

9. System for optimisation of the route of a telecommunication connection to be set up in a telecommunication system comprising a mobile switching  
30 centre (MSC), a service switching point (SSP), a service control point (SCP), a gateway (GW) and a subscriber register (HLR), in which system the service switching point (SSP) is connected to the service control point (SCP) and the gateway (GW) is connected to  
35 the service control point (SCP) and to the subscriber register (HLR), and in which system the telecommunica-

tion connection to be set up is directed via the service switching point (SSP) to the service control point (SCP), characterised in that the gateway (GW) comprises means for handling a database query, a signalling query, a database query response and a signalling query response.

1/2

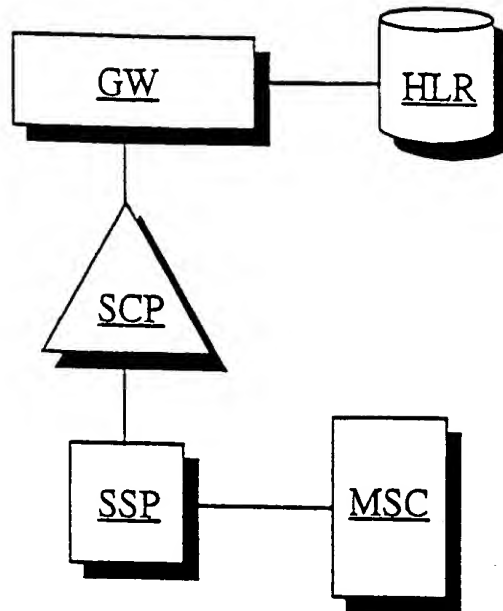


Fig 1

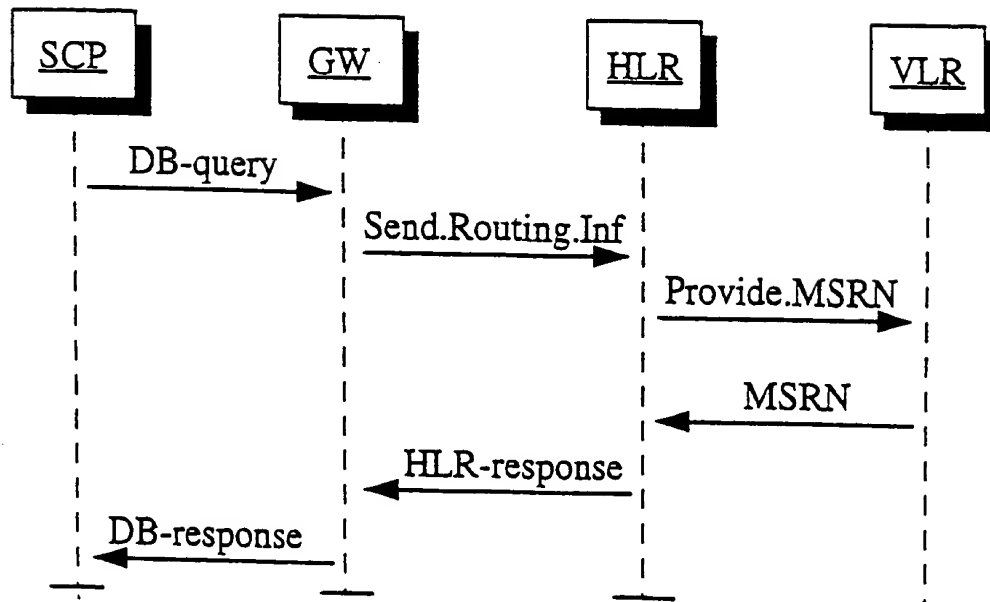


Fig 2

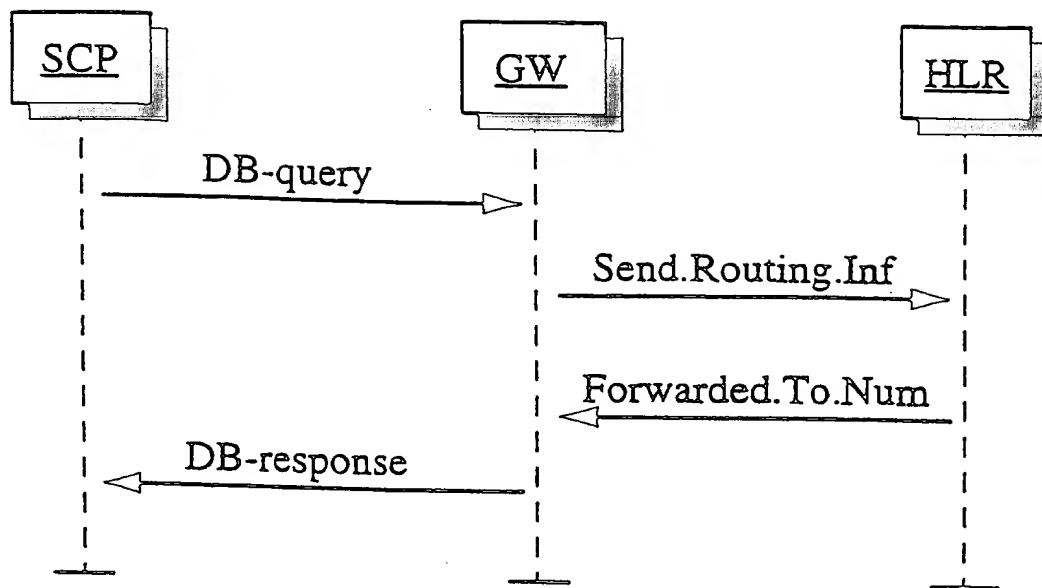


Fig 3

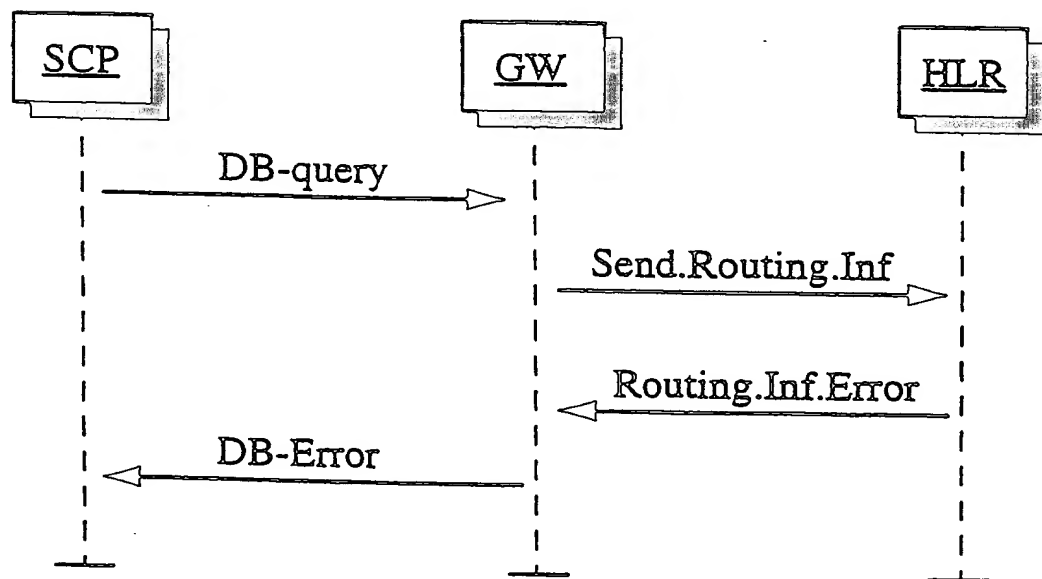


Fig 4

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 98/01010

## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04Q 7/38

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 9417644 A1 (TELEFONAKTIEBOLAGET LM ERICSSON), 4 August 1994 (04.08.94), figures 2,3, abstract --	1-9
Y	US 5839072 A (GUNG-SHIH CHIEN), 17 November 1998 (17.11.98), figure 6, abstract --	1-9
A	WO 9714262 A1 (TELEFONAKTIEBOLAGET LM ERICSSON), 17 April 1997 (17.04.97), page 4, line 13 - page 5, line 4 --	1-9
A	WO 9856206 A1 (TELEFONAKTIEBOLAGET LM ERICSSON), 10 December 1998 (10.12.98) --	

☐ Further documents are listed in the continuation of Box C.
 ☒ See patent family annex.

\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"I" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&amp;" document member of the same patent family

Date of the actual completion of the international search

3 June 1999

Date of mailing of the international search report

06 -06- 1999

Name and mailing address of the ISA/

Swedish Patent Office

Box 5055, S-102 42 STOCKHOLM

Facsimile No. +46 8 666 02 86

Authorized officer

Kristina Pederson/MN

Telephone No. +46 8 782 25 00

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/FI 98/01010

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9417644 A1	04/08/94	AU 673411 B	07/11/96
		AU 5895194 A	15/08/94
		CA 2129666 A	04/08/94
		CN 1101492 A	12/04/95
		GB 2278759 A,B	07/12/94
		GB 9416168 D	00/00/00
		JP 8502870 T	26/03/96
		NZ 259957 A	25/09/96
		SE 9403114 A	16/11/94
		SG 45230 A	16/01/98
		US 5699407 A	16/12/97
US 5839072 A	17/11/98	AU 2661497 A	17/10/97
		EP 0890287 A	13/01/99
		WO 9736451 A	02/10/97
WO 9714262 A1	17/04/97	AU 7349196 A	30/04/97
		CA 2233586 A	17/04/97
		US 5806000 A	08/09/98
WO 9856206 A1	10/12/98	AU 5505498 A	15/07/98
		AU 7356398 A	21/12/98
		SE 9702177 A	07/12/98

**THIS PAGE BLANK (USPTO)**